AMENDMENTS TO THE SPECIFICATION:

Please amend the title of the invention at page 1, line 1, as follows:

~~PROCESSING~~ METHOD OF FORMING A ~~TRANSFERRING~~ DIE SURFACE ~~, PROCESSING MACHINE, DIE FOR~~ TO PRODUCE AN OPTICAL ELEMENT ~~AND A DIAMOND TOOL~~

Please amend the paragraph starting at page 1, line 13, as follows:

In order to mold or produce an optical element by ~~suing~~ using an optical material such as a glass or plastic, when the optical material which is heated and softened, is injected into the cavity formed by the molding die (hereinafter, also called molding die) for the optical element, with a high pressure, or when it is pressed by a molding die (a pressingly forming die) and cooled and solidified, the transfer optical surface shape or surface roughness owned by the die, is molded and transferred to the optical material, and the optical surface is formed, the optical element can be efficiently produced. Because the molding die having this transfer optical surface is brought into contact with the heated optical material with the high pressure, the conditions to secure the long working life ~~as~~ of the molding die, such as ~~the~~ a sufficient heat resistance ~~is sufficient~~, ~~the~~ a low reactivity or wettability ~~is low~~ so that the optical material is not adhered, and ~~the~~ a high and not easily flawed hardness ~~is high and not easily flawed,~~ are necessary, and simultaneously, a condition that the processing is easy and the productivity is high, is ~~requested as the~~ important ~~condition for attaining that~~ to reduce the cost of the molding die production ~~is reduced~~, and as ~~the~~ a result, to lower the cost of the optical element ~~is lowered,~~ and realize an ~~the~~ efficient productivity ~~is realized~~.

Please amend the paragraph starting at page 2, line 20, as follows:

Conventionally, in order to produce the molding die for molding the optical element whose material is glass, material whose heat resistivity is high, such as the ceramic or cemented carbide material is attached to the main shaft of the processing device as shown in Fig. 8, and it is ~~generate-processed~~ processed into the transfer optical surface shape by the cutting processing by a grinding stone using diamond abrasive grains, and in order to further improve its surface roughness, the grinding is conducted as the after processing. Then, when, on the surface of the ~~generate-processed~~ processed transfer optical surface, the protective coating is conducted by the material such as carbon whose wettability with the glass is small, boron nitride of the thickness of about 100 nm to 1 μm to prevent the adhesion to the glass, or precious metal, the molding die is produced. Relating to the production method of the transfer optical surface of these molding dies, is generally described in the patent references 1 - 5. As the ceramic material used for the molding die, the molding die described in Table 1, and it is seen that the hardness is almost not smaller than the Rockwell hardness HRA 90 and is very hard material.

Please amend page 4, line 5, as follows:

[~~Not-Patent~~ Non-patent reference 1]

Please amend the paragraph starting at page 5, line 1, as follows:

Relating to the molding die using the ceramic material, in the case where its point of the problem is further detailed, when the powder of the row material is sintered,

because even when it is the normal pressure sintering or the high pressure sintering, the gap between its powder remains also after sintering, and it becomes a residual bore, there is a case where a minute hole is generated on the optical surface when the cutting processing or grind processing is conducted. This minute hole becomes a cause that it makes the useless minute convex portion, that is, a defect generate on its optical surface when the optical element is molded, or the glass material is fused to the molding die. Therefore, normally, the following processing is conducted that the rough shape processing of the optical surface is conducted by the cutting processing or in the case of conductive ceramic, by the discharge processing described in Tokugan No. 2002-017122, Tokugan No. 2001-359838, on the sintered mold material, and the CVD (Chemical Vapor Deposition) coating of the ceramic material whose linear expansion coefficient is about the same, is conducted from the film thickness 10 μm to 5 mm, and minute ceramic layer is provided, and the cutting processing or grind processing is conducted on this ceramic layer, and the optical surface shape such as an aspheric surface is accurately produced. That is, in the die for optical element molding by the mold material of the ceramic, the main body is the powder sinter material, however, it is [[a]] common that the transfer optical surface portion is made a minute ceramic by the CVD coating, and in order to generate the transfer optical surface shape on such a very minute and high hardness ceramic material at the shape accuracy 50 nm or not higher than that, the cutting processing is conducted by the grind stone using the diamond abrasive grain, and further, the grind processing is conducted as the after processing for the improvement of its processing surface roughness.

Please amend the paragraph starting at page 7, line 10, as follows:

When actually a grind stone or a cutting edge of the cutting tool is cut in the material, it is said that when it is not a fraction ~~several-th~~ of the critical overbear amount, because the processing is advanced by the brittle fracture, the optical mirror surface can not be attained. That is, even in the case of zirconia whose critical overbear amount is maximum, when the depth of cut of the cutting edge of μ-order is not stably realized, the mirror surface can not be generated, and in the above patent references, in the case of silicon carbide which is widely cited as the material of the die for the optical element molding, it can be seen that the transfer optical surface can not be generated when the depth of cut is not at least about 100 nm. As described above, when the transfer optical surface is generated and processed on these ceramic material, it can be said that the processing is very low efficient and the processing of the high difficulty. Because of such a reason, by the cutting tool such as the diamond, by the minute depth of cut of the only one cutting edge, it can be said that a fact that the high accurate transfer optical surface is generated and processed on these ceramic material, is ~~non-efficient~~ inefficient and the tool abrasion is conspicuous, and it can be said that conventionally, it is unthinkable. Further, such instances are not believed to exist ~~even the example of that does not exist~~. Accordingly, conventionally, it is general that, by using the diamond grind stone, by the cutting processing by which the processing efficiency can be maintained high by cutting edges of a plurality of abrasive grains, the transfer optical surface shape is generated, and after that, it is ordinary that a scratch generated by the cutting processing or a chatter mark is removed by the grind processing, and a smooth optical surface is generated.

Please amend the paragraph starting at page 10, line 15, as follows:

As described above, when the composition, particle diameter, or recipe which are appropriate as the transfer optical surface material, [[is]] are selected so that they are appropriate for the optical element molding use die, the hardness of the cemented carbide material for the transfer optical surface is increased on and on, and finally, it becomes not smaller than Rockwell hardness HRA 90. When trade names of the cemented carbide material actually put on the market are viewed, in the general use cemented carbide material C95 (product name) by Fuji dies (Co.) in which cobalt content is 10 and several %, Rockwell hardness is about HRA 81.5, however, in the cobalt-less cemented carbide material RCC-FN (product name) by Nippon tungsten (Co.) which is particularly processed for the purpose of use of the optical element molding use die, the Rockwell hardness reaches HRA 95 by the increase of fineness and HIP processing, and increase of cobalt-free. Relating to these cemented carbide material, when the critical compression depth which is transited from the ductility area to the brittleness area when the diamond pressing piece is compressed, is calculated, in the same manner as the case of ceramic material, from the fracture toughness value, Young modulus, or hardness, as shown in Table 2, in the general use cemented carbide material in which the cobalt content is slightly decreased, it is 56.4 μm, in contrast to that, in the cemented carbide material for the purpose of use of the optical element molding use die, it is 1.83 μm, and it can be seen that it is decreased to about 1/30. When the cutting depth of the cutting edge at the grinding processing or cutting processing is not made to ~~the several th~~ a fraction of this compression amount, because

it is said that the material is brittle fractured, and the optical mirror surface is not formed, and also in the case where the transfer optical surface is generated by the cemented carbide material, it can be understood that, when the material is appropriately selected, in the same manner as the case of ceramic material, it is necessary that, by a very minute cutting amount of 1 μm or less than that, the processing is ~~low-efficiently~~ conducted at a low efficiency.

Please amend the paragraph starting at page 10, line 14, as follows:

As described above, because the optical element molding use die produced by the appropriately selected cemented carbide material, is very hard and easily brittle fractured, the processing is difficult, and in the optical element molding use die by these materials having the transfer optical surface shape such as the aspheric surface having actually the curvature, there is no example that the transfer optical surface is accurately generated and processed by the cutting processing by a single cutting edge, and ~~there is~~ no one has such an idea. Accordingly, conventionally, it is normal that, by using the diamond grind stone, the transfer optical surface generation by the grinding processing by the cutting edge of many abrasive grains, by which the processing efficiency can be maintained high, is generally conducted, and after that, a scratch or chatter mark by the grinding processing is removed by the polishing processing, and a smooth optical surface is generated. Then, on the transfer optical surface, in order to enhance the mold ~~rleasing~~ releasing property from the glass, the film of platinum and the alloy of iridium which are poor in the wetness with the glass, is formed into the thickness not larger than 1 μm, and it is used for the molding of glass optical element.

Please amend the paragraph starting at page 14, line 4, as follows:

However, also in the die for molding of plastic optical element, in the case where its number of production is very large, it reduces the trouble of the die exchange or the stop time of molding that the life of the die is prolonged as long as possible, and becomes important for realizing the good efficient production. Conventionally, the die material such as the above-described electroless nickel plating can easily conduct the diamond cutting, however, on the other side of it, as the hardness, in the Vickers hardness, the upper limit is to about Hv 550, and even when the hardness is increased when the heat processing is conducted and it is crystallized, the upper limit is to about Hv 650 in Vickers hardness. Further, in the molding of plastic optical element, the mold ~~rleasing~~ releasing property of resin material and its die material is comparatively good, however, because the working oil is adhered to the transfer optical surface or the resin material is rarely fused, the operation to remove them is necessary, and there are many cases where the die has minute flaws ~~by~~ resulting from the wipe-out operation.

Please amend the paragraph starting at page 26, line 1, as follows:

The processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 1, is a method by which, because the hardness of the material ~~cfonstituting~~ constituting the transfer optical surface of the optical element molding use die is not smaller than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness, and the transfer optical surface is generated by the cutting processing, for example, when the transfer optical surface of the optical element molding use die for

molding a small diameter optical element is generated, by avoiding the above described problems which can be generated by the grinding processing using the grinding stone, a transfer optical surface with a high accurate shape can be obtained. That is, on the basis of the conventional experiences or knowledge of the concerned persons, although a fact that the transfer optical surface is generated by cutting the raw material having the very high hardness not lower than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness, is an action against to the common sense, the document which affirms it does not exist in the extent confirmed by the inventors. The present inventor faces the difficult problem that, by what method the transfer optical surface of the optical element molding use die is accurately formed by using a raw material having very high hardness not lower than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness, and studies all the processing method without being caught by the conventional common sense, and as the result, it is found that, for example, when the cutting processing is conducted by using the diamond tool, the transfer optical surface can be generated from the raw material having such a high hardness. Furthermore, the present inventor finds that, in the case of the optical element molding use die for molding the small diameter optical element, because the transfer optical surface is also a small diameter, even when the cutting processing is conducted, because the cutting length is short, the wear of the cutting edge per one die can also be suppressed small, and a problem of the cutting edge wear which is one of conventional common sense, can also be avoided.

Please amend the paragraph starting at page 29, line 15, as follows:

In a processing method of a transfer optical surface according to examplary embodiment ~~written in an item~~ 2, the hardness of a material constituting the transfer optical surface of an optical element molding use die is not smaller than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness, and because, while the cutting point of the cutting tool is continuously moved, the transfer optical surface having the curvature is generated by the cutting processing, for example, when the transfer optical surface of the optical element molding use die for molding a small diameter of optical element is generated, by avoiding the above-described problem which can be generated in the grinding processing using a grinding stone, the transfer optical surface with the high accurate shape can be obtained.

Please amend the paragraph starting at page 30, line 6, as follows:

In a processing method of a transfer optical surface according to examplary embodiment ~~written in an item~~ 3, the hardness of a material constituting the transfer optical surface of an optical element molding use die is not smaller than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness, and because, while the cutting point of the cutting tool is fixed at one point, or kept in the angle range within ± 15°, the transfer optical surface having the curvature is generated by the cutting processing, for example, when the transfer optical surface of the optical element molding use die for molding a small diameter of optical element is generated, by avoiding the above-described problem which can be generated in the grinding processing using a grinding stone, the transfer optical surface with the high accurate shape can be obtained.

Please amend the paragraph starting at page 30, line 20, as follows:

Hereupon, when the cutting processing is conducted on a material with the very high hardness, the wearing of the cutting edge of the cutting tool is generated more or less even when the transfer optical surface to be cut has a small diameter. However, the important point herein is ~~a point~~ that total cutting length becomes short as the transfer optical surface to be cut becomes a small diameter, and accordingly, because a wear amount of the cutting edge becomes very small, ~~the high~~ highly accurate cutting can be conducted while the processing cost is being suppressed. Accordingly, as in the present invention, when the cutting point is fixed at one point on the cutting edge of the tool, or when kept in the angle range within ± 15°, because the wear of the tool cutting edge used for the cutting processing, is monotonously increased without being unstably advanced by the anisotropy of the cutting edge material, the error of the processed shape of the transfer optical surface generated by this wear of the cutting edge, is gently and monotonously increased according to the processing direction, between the center of the optical surface and the periphery. Because there is no case that such a shape error is locally and rapidly changed, the correction can be very easily conducted when the notching amount of the cutting edge is made to be monotonously increased, for example, at the time of next cutting processing. That is, according to the present invention, while the wear of the tool cutting edge accompanied by the cutting processing is considered, an effect that the transfer optical surface of the optical element molding use die can be high accurately processed, is obtained. Hereupon, "to be kept in the angle range within ± 15° " means that, when the cross section including the optical axis of the transfer optical surface and cutting point is taken, and the secondary dimensional

coordinate system on the basis of the transfer optical surface is set, a line segment drawn from the rotation center of the tool to the cutting point in such a coordinate system is oscillated at an angle of maximum 30° at the time of processing.

Please amend the paragraph starting at page 32, line 11, as follows:

When the diamond tool is used as a cutting tool, it is well known that, by the crystal orientation of the diamond used for the cutting edge, the wearing amount of the tool is largely different. Accordingly, in the case where the cutting processing is conducted on the transfer optical surface of the ceramic material or cemented carbide optical element molding die, when the cutting processing is conducted by using only the crystal orientation in which the wear of the diamond is small, because the wearing amount of the tool is reduced and the tool life is prolonged, a large amount of molding use dies can be processed. For example, by using the hyper precision processing machine shown in Fig. 13 in which the revolving shaft (B shaft) is provided on the tool table of 2-axis hyper precision processing machine, when the <110> orientation of (100) surface in which the wearing amount of the diamond tool is the minimum, or the <110> orientation of (110) surface is attached so that the cutting edge of the diamond tool produced in such a manner that it is a clearance surface or a cutting face of the cutting edge, is positioned, and it is made so that the cutting edge is always positioned at the processing point of the transfer optical surface to be processed (so that cutting point is fixed constant), that is, when the cutting processing is conducted by the simultaneous 3-axis drive so that the crystal orientation in which the wearing amount is reduced is always the normal line direction of the transfer optical surface, because the wear of the

tool is small, and the shape of the cutting edge can be kept well over the long cutting length, the number of the time of the tool exchange is reduced, and its trouble and the lowering of the operation rate of the processing machine can be suppressed (~~an item~~ see examplary embodiment 3 and ~~items~~ examplary embodiment 6, 10 - 15 which will be described later).

Please amend the paragraph starting at page 35, line 5, as follows:

In the case where ~~further~~ more accurate transfer optical surface is generated, as ~~written~~ in ~~an item~~ examplary embodiments 2 and ~~item~~ 5 which will be described later, in the cutting edge rake face of the diamond tool, because a side of a system using a hyper precision lathe of 2-axis motion in which the cutting point is continuously moved is smaller in the dispersion error in the processing shape, and the deviation error by the tool wear is main, when this deviation error is small, the transfer optical surface can be more efficiently generated.

Please amend the paragraph starting at page 35, line 14, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 4, because the critical compression depth of the material constituting the transfer optical surface of the optical element molding use die is not larger than 5 μm, and that transfer optical surface is generated by the cutting processing, it can avoid the above-described problem which can be generated in the grinding processing using the grinding stone, for example, when the transfer optical surface of the optical element molding use die for molding a small diameter optical

element is generated, and can obtain the transfer optical surface with ~~the high~~ highly accurate shape.

Please amend the paragraph starting at page 36, line 3, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 5, because the critical compression depth of the material constituting the transfer optical surface of the optical element molding use die is not larger than 5 μm, and the transfer optical surface having the curvature is generated by the cutting processing, while the cutting point of the cutting tool is continuously moved, it can avoid the above-described problem which can be generated in the grinding processing using the grinding stone, for example, when the transfer optical surface of the optical element molding use die for molding a small diameter optical element is generated, and can obtain the transfer optical surface with ~~the high~~ a highly accurate shape.

Please amend the paragraph starting at page 36, line 16, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 6, because the critical compression depth of the material constituting the transfer optical surface of the optical element molding use die is not larger than 5 μm, and the transfer optical surface having the curvature is generated by the cutting processing, while the cutting point of the cutting tool is fixed at one point, or while it is kept in the angle range within ± 15°, it can avoid the above-described problem which can be generated in the grinding processing using the grinding

stone, for example, when the transfer optical surface of the optical element molding use die for molding a small diameter optical element is generated, and can obtain the transfer optical surface with ~~the high~~ a highly accurate shape.

Please amend the paragraph starting at page 37, line 8, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 7, in any one of the inventions described in examplary embodiments ~~items~~ 1 to 6, when the shape of the transfer optical surface is an aspheric surface, the aberration characteristic of the molded optical surface of the optical element which is ~~transfer-formed~~ formed from that transfer becomes good.

Please amend the paragraph starting at page 37, line 14, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 8, in any one of the inventions described in examplary embodiments ~~items~~ 1 to 7, when the effective diameter of the transfer optical surface is not larger than 5 mm, because the grinding processing by a grinding stone becomes difficult, and the cutting length becomes short, a merit of the cutting processing can be easily obtained.

Please amend the paragraph starting at page 41, line 7, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 9 is preferable because, in any one of the inventions of examplary embodiments ~~items~~ 1 to 9, when the tool cutting edge used for the cutting

processing is structured by a diamond, the cutting processing of material not smaller than Rockwell hardness HRA 80 or Hv 1000 in Vickers hardness can be effectively conducted.

Please amend the paragraph starting at page 41, line 14, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 10 is characterized in that: in any one of the inventions of examplary embodiments ~~items~~ 1 to 9, the cutting processing is conducted when the tool cutting edge structured by the diamond and the transfer optical surface of the optical element molding use die are relatively moved along a predetermined direction on the basis of the crystal orientation of the diamond.

Please amend the paragraph starting at page 53, line 19, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 11 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond has the cutting face faced to the forward direction in the cutting direction at the time of processing, to the transfer optical surface of the optical element molding use die to be cut, and the flank faced to the backward direction in the cutting direction, and the cutting face is made the (110) surface of the diamond, and the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face along the (110) surface of the diamond existing in the direction in which it crosses with the cutting face, therefore, the transfer optical surface in which the tool

wear is small and the shape correction is easy, can be generated. Hereupon, "the cutting face is made the (110) surface of the diamond" does not means that the cutting face and the (110) surface are not always made parallel to each other, but, for example, both may be inclined in the range of ± 15°.

Please amend the paragraph starting at page 54, line 17, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 12 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond has the cutting face faced to the forward direction in the cutting direction at the time of the processing, and the flank faced to the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and the cutting face is made the (110) surface of the diamond, and the cutting processing is conducted while the transfer optical surface of the optical element molding use die is made to relatively move to the cutting face, in the angle range of ± 15° to the (110) surface of the diamond existing in the direction which crosses with the cutting face, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 55, line 10, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 13 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond

has the cutting face faced to the forward direction in the cutting direction at the time of the processing, and the flank faced to the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and the cutting face is made the (110) surface of the diamond, and the cutting processing is conducted while the transfer optical surface of the optical element molding use die is made to relatively move to the cutting face, along the (100) surface of the diamond existing in the direction which crosses with the cutting face, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 56, line 4, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 14 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond has the cutting face faced to the forward direction in the cutting direction at the time of the processing, and the flank faced to the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and the cutting face is made the (110) surface of the diamond, and the cutting processing is conducted while the transfer optical surface of the optical element molding use die is made to relatively move to the cutting face, in the angle range of ± 15° to the (100) surface of the diamond existing in the direction which crosses with the cutting face, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 56, line 20, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 15 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond has the cutting face faced to the forward direction in the cutting direction at the time of the processing, and the flank faced to the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and the cutting processing is conducted when the transfer optical surface of the optical element molding use die is made to relatively move to the cutting face, along the (111) surface of the diamond, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 57, line 12, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 16 is characterized in that: in the invention ~~written in an item~~ according to examplary embodiment 10, the tool cutting edge structured by the diamond has the cutting face faced to the forward direction in the cutting direction at the time of the processing, and the flank faced to the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and the cutting processing is conducted when the transfer optical surface of the optical element molding use die is relatively moved to the cutting face, in the angle range of ± 15° to the (111) surface of the diamond, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 58, line 3, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 17 is characterized in that: in the invention described in any one of examplary embodiments ~~items~~ 10 - 16, a rake angle of the cutting face of the tool cutting edge is within 0 ± 15°, and therefore, the transfer optical surface in which the tool wear is small and the shape correction is easy can be produced.

Please amend the paragraph starting at page 58, line 10, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 18 is characterized in that: in the invention described in any one of examplary embodiments ~~items~~ 10 - 17, the cutting processing is conducted while the tool cutting edge structured by the diamond is rotated in the surface including the optical axis of the transfer optical surface of the optical element molding use die to be cut, and the cutting point.

Please amend the paragraph starting at page 58, line 18, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 19 is characterized in that: in the invention described in any one of examplary embodiments ~~items~~ 10 - 18, a normal line angle of the transfer optical surface of the optical element molding use die which is the cutting processed by using the tool cutting edge structured by the diamond is not smaller than 30°.

Please amend the paragraph starting at page 59, line 3, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 19 is, in the invention described in any one of examplary embodiments ~~items~~ 10 - 19, when the hyper precision processing machine in which the control resolving power of a shaft holding the cutting tool of the processing machine used for the cutting processing or the transfer optical surface, is not larger than 100 nm, is used, ~~the high~~ highly accurate transfer optical surface can be produced.

Please amend the paragraph starting at page 60, line 5, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 21 is, in the invention described in an examplary embodiment ~~item~~ 20, it is preferable when the hyper precision processing machine has a movable portion not smaller than 3 axes (for example, 3-axis processing machine).

Please amend the paragraph starting at page 60, line 10, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 22 is, in the invention described in any one of examplary embodiments ~~items~~ 1 - 21, when the cutting processing is conducted again while the cutting tool used for the cutting processing or the transfer optical surface is made to relatively move corresponding to the obtained difference when the shape of the transfer optical surface cutting produced by the cutting processing is measured, and the difference between the measured shape and ideal shape is obtained, ~~the high~~ highly accurate transfer optical surface can be produced.

Please amend the paragraph starting at page 60, line 20, as follows:

When ceramic which is a difficult processing material in which the hardness is high and the critical indentation depth is shallow, or cemented carbide material is cutting processed in the ductile mode, because, when it is a small diameter transfer optical surface, the cutting length is short, it is described that the processing can be completed while the wear of the cutting edge is small. However, in the case of the transfer optical surface processing of the molding use die for molding ~~the high~~ a highly accurate optical element, the processing shape error generated when the shape of the tool cutting edge is changed by the wear, can not be disregarded.

Please amend the paragraph starting at page 61, line 9, as follows:

In this case, when the cutting processed transfer optical surface shape is measured by an appropriate shape measuring device, and an error between the sectional shape of the transfer optical surface and the ideal shape is found, and about the same amount is corrected by adjusting the notching amount of the tool by the next cutting processing and the shape is produced, ~~the high~~ highly accurate transfer optical surface can be obtained. This is from a reason that, in the case of the cutting processing, because the notching amount of the cutting edge is almost equal to the removal depth, when an amount of the shape error is superposed on the notching amount, the correction processing can be realized with good reproducibility. In order to realize such a shape correction processing, when a shape measuring device and the shape error clearly seen thereby, are taken into a personal computer as the data of

sequence of points, and the shape correction amount is found by conducting the calculation which will be later, and it is superposed on a part program for driving the hyper precision processing machine, and a new part program is outputted from a personal computer, it can be comparatively simply realized. When the shape correction processing is not conducted by the axial motion of the hyper precision processing machine, but by another actuator, the tool or the molding use die which is a work piece is driven, it is not necessary to make again the part program, and it may be allowable when there is a mechanism to control the notching amount of the tool by operating the actuator while being in timed relationship with the original axial movement.

Please amend the paragraph starting at page 64, line 9, as follows:

There is a characteristic also in that, to produce ~~the high~~ a highly accurate transfer optical surface in the die for molding of the ceramic material or hyper cemented carbide material of the present invention by cutting processing, the shape correction processing to which such limitation of a notching amount is added, is conducted.

Please amend the paragraph starting at page 64, line 15, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 23, when the ~~judgement~~ judgment of the goodness or poorness of the processing shape is conducted by finding the error component of each item of the polynomial of Zernike according to the shape error (for example, it corresponds to the difference between the measured shape and ideal shape) and by

comparing to a predetermined value, in the invention of an examplary embodiment ~~item~~ 22, it is preferable from the following reasons.

Please amend the paragraph starting at page 68, line 3, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 24 is preferable, in the invention of any one of examplary embodiments ~~items~~ 1 to 23, when the optical element molding use die is attached to the rotational axis of the processing machine which conducts the cutting processing, and in the processing process, the shape of the transfer optical surface can be measured without being dismounted from the rotational axis.

Please amend the paragraph starting at page 70, line 21, as follows:

When the above description is summed up, in order to cutting process ~~the high~~ a highly accurate transfer optical surface on the die for molding of the ceramic material or cemented carbide material, without the die for molding being dismounted, the cutting processing shape is measured on the machine, and based on the shape error, the shape correction amount adjusted to the notching amount of the tool cutting edge of which the ductile mode is formed, is found, and when the correction shape processing is conducted, the generation of the good efficient transfer optical surface by which the processing time is short and the number of tools for processing the transfer optical surface is also increased, can be realized. Further, for the shape error or approximation fitting of the shape correction amount, when the polynomial of ~~Zelnike~~ Zernike is used, and the correction processing is conducted by the coefficient value for each its

component, the effect of the correction or the influence which affects the optical performance of the molded optical element can be presumed, and it is effective. As such a measuring device, a measuring device in which, for example, the laser light is irradiated on the processed optical transfer surface and by the reflected light, the shape of the transfer optical surface is measured, or a measuring device which is a tracer type, and in which the processed transfer optical surface is profiled by the axial motion of the processing machine and measured, can be used.

Please amend the paragraph starting at page 72, line 1, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 25, in any invention of examplary embodiments ~~items~~ 1 - 24, it is preferable that the optical element molding use die is a molding use die for molding the optical element whose raw material is plastic, and when the transfer optical surface is a surface for transferring the optical surface of the optical element.

Please amend the paragraph starting at page 72, line 1, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 26, in any invention of examplary embodiments ~~items~~ 1 - 24, it is preferable that the optical element molding use die is a molding use die for molding the optical element whose raw material is glass, and when the transfer optical surface is a surface for transferring the optical surface of the optical element.

Please amend the paragraph starting at page 72, line 15, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 27, in any invention of examplary embodiments ~~items~~ 1 - 26, it is preferable when at least the material of the transfer optical surface to be cutting processed in the optical element molding use die is the cemented carbide.

Please amend the paragraph starting at page 72, line 20, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 28, in any invention of examplary embodiments ~~items~~ 1 - 26, it is preferable when at least the material of the transfer optical surface to be cutting processed in the optical element molding use die is the ceramic.

Please amend the paragraph starting at page 73, line 3, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 29 is preferable, in the invention of an examplary embodiment ~~item~~ 28, when the ceramic material of the transfer optical surface to be cutting processed is silicon carbide.

Please amend the paragraph starting at page 73, line 7, as follows:

A processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 30 is preferable, in the invention of an examplary embodiment ~~item~~ 29, when the ceramic material of the transfer optical surface to be cutting processed is the silicon carbide produced by CVD.

Please amend the paragraph starting at page 73, line 12, as follows:

In a processing method of the transfer optical surface ~~written in an item~~ according to examplary embodiment 31, in any one of inventions of examplary embodiments ~~items~~ 1 - 30, when the transfer optical surface is polishing processed after the cutting processing, the finishing of the transfer optical surface can be finely conducted. Hereupon, it is arbitrary that the transfer optical surface is rough grinding processed before the cutting processing.

Please amend the paragraph starting at page 73, line 19, as follows:

A processing machine ~~written in an item~~ according to examplary embodiment 32 is preferable when it is used for the processing method of the transfer optical surface written in any one of examplary embodiments ~~items~~ 1 - 31.

Please amend the paragraph starting at page 73, line 22, as follows:

An optical element molding use die ~~written in an item~~ according to examplary embodiment 33 is preferable when it is formed by the processing method of the transfer optical surface written in any one of examplary embodiments ~~items~~ 1 - 31.

Please amend the paragraph starting at page 74, line 3, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 34 is a diamond tool structured by the diamond having a cutting face faced the forward direction in the cutting direction at the time of processing, and a flank faced the

backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the cutting face is made the (110) surface of the diamond, and the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, along the (110) surface of the diamond which exists in the direction crossing the cutting face. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 11.

Please amend the paragraph starting at page 74, line 16, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 35 is a diamond tool structured by the diamond having a cutting face faced the forward direction in the cutting direction at the time of processing, and a flank faced the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the cutting face is made the (110) surface of the diamond, and the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, in the angle range of ± 15° to the (110) surface of the diamond which exists in the direction crossing the cutting face. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 12.

Please amend the paragraph starting at page 75, line 7, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 36 is a diamond tool structured by the diamond having a cutting face faced the forward

direction in the cutting direction at the time of processing, and a flank faced the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the cutting face is made the (110) surface of the diamond, and the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, along the (100) surface of the diamond which exists in the direction crossing the cutting face. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 13.

Please amend the paragraph starting at page 75, line 20, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 35 is a diamond tool structured by the diamond having a cutting face faced the forward direction in the cutting direction at the time of processing, and a flank faced the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the cutting face is made the (110) surface of the diamond, and the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, in the angle range of ± 15° to the (100) surface of the diamond which exists in the direction crossing the cutting face. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 14.

Please amend the paragraph starting at page 76, line 11, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 37 is a diamond tool structured by the diamond having a cutting face faced the forward direction in the cutting direction at the time of processing, and a flank faced the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, along the (111) surface of the diamond. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 15.

Please amend the paragraph starting at page 76, line 22, as follows:

A diamond tool ~~written in an item~~ according to examplary embodiment 39 is a diamond tool structured by the diamond having a cutting face faced the forward direction in the cutting direction at the time of processing, and a flank faced the backward direction in the cutting direction, to the transfer optical surface of the optical element molding use die to be cut, and which is characterized in that: the transfer optical surface of the optical element molding use die is cutting processed while it is relatively moved to the cutting face, in the angle range of ± 15° to the (111) surface of the diamond. The effect of the present invention is the same as the invention ~~written in an item~~ according to examplary embodiment 16.

Please amend the paragraph starting at page 82, line 15, as follows:

The processing is conducted under the condition that the cutting face radius of the tool cutting edge is 0.5 mm, notching amount is 100 nm, and feed speed is 0.2 mm/min. The cutting time of one time is about 10 minutes, and at the time point at which the processing is conducted 10 times, the rough cutting grinding processing surface can be removed, and the optical mirror surface can be produced. At this time point, the shape of the processed surface is measured, the error from the ideal shape is found, and the correction processing by which the notching amount of the tool is continuously increased or decreased so as to correct it depending on the processing position, is conducted. Specifically, an error amount measured in the shape measurement of the transfer optical surface is fitted by the continuous polynomial and the shape error is expressed, by ~~Zeknike's~~ Zernike's polynomial development equation which is generally used in the wave-front aberration analysis of the optical element, and a value of the coefficient of each term is found. Because when there is the coefficient value up to the order of about 9-th order or so, the error shape can be expressed with enough accuracy, the axial motion whose magnitude is the same as the error amount and whose direction is reversal, is superposed on the NC program of the processing machine, and the notching amount of the tool is corrected so that the notching amount can continuously correct the error, and the processing is conducted. In this correction concept, as described above, in the cutting processing in which the tool cutting edge is not almost elastically deformed, it is used that the notching amount of the cutting edge and the removal depth correspond in about 1 to 1, and it is a correction method whose reproducibility is very high. A sequential time of this shape correction processing is

15 minutes per one time, and at the time point at which 4 times processing are conducted, the shape error of the processed transfer optical surface is decreased to not larger than 50 nm as shown in Fig. 2, and because it enters into the desired tolerance, the cutting processing is completed.